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DaimlerChrysler AG

Driver's cab supporting structure for a commercial vehicle having a safety cell

The invention relates to a driver's cab supporting structure for a commercial vehicle having a safety cell, in particular for a heavy commercial vehicle, according to the precharacterizing clause of claim 1.

The patent specification EP 0 718 176 B1 discloses a supporting structure for a driver's cab of a commercial vehicle, said driver's cab, including the doors, being designed as a safety cell for driver and passenger. The driver's cab is reinforced and stiffened by a stiffening rib integral to the wall. The all-round stiffening of the driver's cab is provided in three height positions, in the region of the driver's cab floor, in the region of the transition to the roof and in the railing region below the windshield. Forces acting in the horizontal direction from the outside can be counteracted in a specific manner in the three zones. The driver's cab is less deformed than in previously known solutions. To stiffen it, the front wall, rear wall and side walls of the driver's cab are reinforced by a profiling, brought about by a pressing technique, of their inside and outside sheet-metal pressed parts and by partial further reinforcement of these stiffening profile regions with additional sheet-metal pressed profiles. The reinforcements are of encircling design in the three height positions and in vertical planes in the region of the A- or hinge pillars, the B- or lock pillars, the C-pillars and at least one pillar in the rear wall.

It is the object of the invention to improve a driver's cab supporting structure for a commercial vehicle

having a safety cell, in particular for a heavy commercial vehicle.

The object is achieved according to the invention by the features of claim 1.

In the case of the driver's cab supporting structure according to the invention, a seating region is surrounded by a stiff, cage-like safety cell to which a deformation region for absorbing deformation energy is connected between seating region and loading region. The safety cell is of particularly stiff design while the deformation region is of particularly pliable design, so that the driver's cab is stiffened locally and is weakened in a specific manner locally with the effect of providing a deformation zone. The effect which can therefore be achieved is that, in the event of a rear-end collision, for example of truck against truck, in which a driver's cab is compressed until stiff structures of the colliding truck can be effectively supported, an adequate survival space for a driver in the colliding truck is maintained. This is advantageous particularly in the case of heavy commercial vehicles of several tens of tonnes, since, in the case of a rear-end collision, kinetic energy can scarcely be supported via the driver's cab. An effective support therefore generally takes place on a frame of the above truck or its trailer. A superstructure penetrates the colliding driver's cab in accordance with a rear overhang and an elasticity of the front structure of the colliding commercial vehicle. The differing stiffness according to the invention of the driver's cab makes available a necessary compression volume behind the seating region while the seating region is protected by the stiff safety cell. The safety cell can be displaced in essentially undeformed form while the kinetic energy is converted in the compression volume of the deformation region into deformation energy. Preferably, at least

the driver's seat is surrounded by the stiff safety cell.

If the safety cell is arranged displaceably with respect to a vehicle frame, even if the protruding superstructure of the truck traveling in front dips inward, the safety cell can remain intact and a survival space can be maintained. If the driver's cab or the longitudinal member is affected by an impact, as a reaction the safety cell can move relative to the vehicle frame and can conduct energy to the deformation region. The safety cell remains intact.

If the deformation region comprises part of the driver's cab, then, in the case of a driver's cab of sufficient size, preferably with a living and sleeping region behind the seating region, a large compression volume can be achieved. The driver's cab is preferably designed as a deformation region in the living or sleeping region arranged behind the seating region.

If a part of a longitudinal member behind the seating region is designed as a deformation region, a further compression volume can be made available. This design is suitable in particular for a short driver's cab without a living and sleeping region, in which a substantial compression volume is not available in the driver's cab itself. The deformation region is preferably integrated in the longitudinal member behind the seating region and a support against a vehicle frame.

If the longitudinal member has an absorbing region which is mounted upstream of the safety cell, in the case of an accident an impact can be prevented from acting directly on the safety cell and, instead, the impact acts on the deformation region of the longitudinal member and, if appropriate, on an

additional deformation region in front of the driver's cab.

If the longitudinal member is of L-shaped design, with a first limb of the longitudinal member being placed as absorbing region in front of the safety cell and the safety cell being mounted on a second limb, a front region of the driver's cab can effectively be prevented from an intrusion. An impact energy can be diverted to the deformation region or the deformation regions.

If the safety cell is designed in the manner of a cuboid, with cuboid edges being formed by roll bars, this permits a favorable encapsulation of the driver's seat and/or passenger's seat by the safety cell and makes it easier in an accident to rescue occupants.

If the safety cell is formed from a separate driver's cell and a separate passenger's cell, then, in the case of an impact on one side, the safety of the less affected cell can be increased, since, in the event of an impact, the two cells are essentially decoupled or can be decoupled from each other and are at least movable in relation to each other. A connection between driver's cell and passenger's cell is expediently of pliable or releasable design, so that, in the event of deformation, the safety cells can be released from each other and can react independently of each other.

If an additional deformation region is mounted upstream of the safety cell, an additional compression volume can be provided and the safety of the occupants can be increased.

Further advantages emerge from the description below of the drawing, in which the invention is explained in more detail with reference to two exemplary embodiments. The drawing, the description and the claims contain numerous features in combination. A

person skilled in the art will expediently also consider the features individually and put them together to form meaningful further combinations. In the drawing:

Fig. 1 shows, diagrammatically, a side view of a preferred commercial vehicle with deformation zones indicated, according to a first exemplary embodiment,

Fig. 2 shows a rear-end collision situation between a commercial vehicle and the preferred commercial vehicle from Fig. 1, with deformed deformation zones,

Fig. 3 shows a rear-end collision situation of two conventional commercial vehicles for comparison,

Fig. 4 shows a preferred safety cell,

Figs. 5a, b, c show a preferred commercial vehicle according to a second exemplary embodiment in side view (a), a detail of a deformation zone (b), and the deformation zone after a rear-end collision situation (c).

In the figures, identical or corresponding parts are basically numbered with the same reference numbers.

Fig. 1 shows, diagrammatically, a side view of a preferred commercial vehicle with deformation regions 5, 6 indicated, in a driver's cab 1 according to a first exemplary embodiment. The deformation regions 5, 6 comprise part of the driver's cab 1. A loading region 38, for example a trailer, is connected to a rear side 3 of the driver's cab 1. A deformation region 6 is arranged in a front region 2 of the driver's cab 1 and sits over an end piece 7 of a stiff vehicle frame. A

further deformation region 5 is arranged in the region of the rear side 3. A safety cell 4 which surrounds a seating region (not designated specifically) is arranged between the deformation region 6 on the front side and the rear deformation region 5.

Fig. 2 shows the commercial vehicle from Fig. 1 in a rear-end collision situation, in which the colliding commercial vehicle is supported with its end piece 7 of the vehicle frame in a contact region 9 on the vehicle frame of the front commercial vehicle.

The driver's cab 1 is compressed in the deformation regions 5, 6 of the front region 2 and of the rear side 3, and the safety cell 4 is displaced rearward with respect to the vehicle frame (not designated specifically). A clearance R, within which the safety cell 4 is located, is maintained between the two trucks.

The situation with a conventional commercial vehicle is illustrated in Fig. 3 as a comparison. A conventional driver's cab 1 of overall stiff design is compressed from the front, and a region 8 on the rear side 3 of the driver's cab 1 remains intact if the vehicle frames of the two involved commercial vehicles strike against each other in the contact region 9.

Fig. 4 shows a preferred supporting structure of a driver's cab 1 with a safety cell 4. In the front region 2 (Figs. 1 and 2) there is arranged a stiff, cage-like safety cell 4 to which a pliable deformation region 5 for absorbing deformation energy is connected. The deformation region 5 is arranged between a seating region 13 and the loading region 38 from Figs. 1, 2. The deformation region 5 is formed from pliable longitudinal struts 33, 35 transverse struts 31, 34 and vertical struts 32 and surrounds a living and sleeping region of the driver's cab 1.

The safety cell 4 is designed here for a driver's seat (not illustrated) and a passenger's seat (not illustrated) and is composed of a driver's cell 10 and a passenger's cell 11. The driver's cell 10 and the passenger's cell 11 are connected on that side of the safety cell 4 which faces the rear side 3 of the driver's cab 1 by a pliable strut 36 on the roof side and a pliable strut 14 arranged on the floor side in the front region. In the front region 2, a stiff transverse strut 12 on the roof side and a stiff transverse strut 26 connect driver's cell 10 and passenger's cell 11 level with a windshield railing.

The safety cell 4 is essentially symmetrical to a center line 40 on the roof side and a center line 41 on the front side. For the sake of clarity, only reference numbers for the driver's cell 10 are indicated.

The supporting structure according to the invention comprises at least the stiff safety cell 4 and the longitudinal member 30. In addition, in this exemplary embodiment, a pliable deformation region 5 is arranged adjoining the safety cell 4.

The driver's cab 1 is mounted on a driver's cab bearing 15 of a longitudinal member 30, in which a part behind the seating region 13 is designed as a deformation region 17.

The longitudinal member 30 has an absorbing region 29 which is mounted upstream of the safety cell 4. The longitudinal member 30 is of L-shaped design, with the absorbing region 29 forming a first limb 29 which is placed in front of the safety cell 4. The safety cell 4 is mounted on a second limb the driver's cab 1. The safety cell 4 is designed such that it can be displaced with the longitudinal member 30 with respect to a

vehicle frame. A rear driver's cab bearing 16 can be supported on the vehicle frame.

The safety cell 4 is designed in the manner of a cuboid, with cuboid edges being formed by stiff struts 18, 20, 24, 28 arranged along a vehicle axis, stiff struts 23, 22, 26, 44, 45 arranged transversely to the vehicle axis, and stiff struts 19, 21, 25, 27 arranged vertically. The vertical strut 25 forms a roll bar with the strut 22 arranged transversely. It is optionally also possible for a vertical, stiff strut 25 behind the driver's seat to be omitted or for such a strut only to be provided in the driver's cell 10, in order to save weight.

A vehicle door (not illustrated) which is stiffened and/or reinforced can be provided in the door region 46 and, for example, has a conventional beam function with annular structures, so that protection, for example, against a lateral penetration of deformation energy or else an additional stiffening of the vehicle door in the case of head-on collisions can be assisted.

Furthermore, a support for a dashboard (not illustrated) is provided in the driver's cab 1, so that, in the event of deformation, a penetration of the dashboard into the safety cell 4 can be avoided.

Figs. 5a, b, c show a supporting structure of a driver's cab according to a second exemplary embodiment. The supporting structure comprises a stiff safety cell 4 and a longitudinal member 30 with an integrated deformation region 17 (Fig. 5a). The driver's cab 1 is of short design and does not have a living and sleeping region on the rear side 3. The driver's cab 1 is mounted on an L-shaped longitudinal member 30 which has an upwardly placed limb as absorbing region 29 in a front region 2 of the driver's cab 1. In the region of the rear side 3 of the driver's

cab 1, a deformation region 17 is arranged in the longitudinal member 30, between a seating region 13, surrounded by a stiff, cage-like safety cell 4, and a support 42. In the event of an application of force from the front, the safety cell 4 can yield to the rear and can move in a specific manner relative to a vehicle frame 43. The support 42 supports the longitudinal member 30 against a vehicle frame 43 (Fig. 5b). Fig. 6 shows the longitudinal member 30 in the normal state. The safety cell 4 (not illustrated) sits between absorbing region 29 and deformation region 17. The driver's cab 1 is supported on a front driver's cab bearing 15.

Fig. 5c shows the longitudinal member 30 in the deformed state after a rear-end collision. The front region of the longitudinal member 30, on which the safety cell 4 sits, is unchanged while the deformation region 17 is compressed. The deformation region 17 is arranged behind the driver's cab. If a force acts on the absorbing region 29, which is designed as the erected limb, said force is conducted via the longitudinal member 30 to the deformation region 17 where it is converted into deformation work. The safety cell 4 is displaced rearward in essentially undeformed form.

The deformation regions 5, 6, 17 are preferably formed from conventional crash structures, such as, for example, foldable or compressible structures of profiled material, such as tubes or U-supports and the like.

The invention can be integrated easily and in an uncomplicated fashion in drivers' cabs and is suitable particularly for cab-over-engine trucks which do not have a front structure on the front side for accommodating deformation regions.